# Prevalence of gestational diabetes mellitus among Swampy Cree women in Moose Factory, James Bay

*Evidence*

*Études*

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See related articles pages 1293 and 1315

## Abstract

**Background:** Although high rates of gestational diabetes mellitus have been documented in native populations, few studies have examined rates of the disease among native Indians in Canada. The authors conducted a study to estimate the prevalence of gestational diabetes among Swampy Cree women, to identify factors predictive of the occurrence of gestational diabetes, and to identify delivery and infant outcomes related to the presence of the disease.

**Methods:** Information on Swampy Cree women who gave birth at Weeneebayko Hospital, Moose Factory, James Bay, Ont., between 1987 and 1995 was obtained from medical charts. Patients with and without gestational diabetes were compared. Logistic regression analysis was used to identify independent predictors of gestational diabetes. Delivery and infant outcomes that occurred secondary to gestational diabetes were also identified by means of logistic regression.

**Results:** A total of 1401 deliveries occurred at Weeneebayko Hospital over the study period, of which 1298 were included in the study. Gestational diabetes was diagnosed in 110 (8.5% [95% confidence interval (CI) 6.9%–9.9%]) of the 1298 pregnancies. Factors predictive of gestational diabetes were age 35 years or more (relative risk [RR] 4.1, 95% CI 1.5–11.7), a history of gestational diabetes in a previous pregnancy (RR 6.4, 95% CI 3.5–11.7), diastolic blood pressure of 80 mm Hg or higher at the first prenatal visit (RR 1.7, 95% CI 1.1–2.8), weight greater than 80 kg at the first prenatal visit (RR 4.9, 95% CI 1.8–12.9) and having a first-degree relative with diabetes (RR 3.0, 95% CI 1.4–6.1). The only delivery outcome independently associated with the presence of gestational diabetes was an increased likelihood of needing assisted delivery (forceps or vacuum extraction) (RR 2.8, 95% CI 1.1–7.0). Shoulder dystocia was indirectly associated with gestational diabetes owing to increased infant birth weight. Infant outcomes associated with the presence of gestational diabetes were birth weight greater than 4500 g (RR 2.4, 95% CI 1.4–3.8), hyperbilirubinemia (RR 2.9, 95% CI 1.4–6.1), hypoglycemia (RR 7.3, 95% CI 3.7–14.4) and hypocalcemia (RR 8.9, 95% CI 2.3–33.7).

**Interpretation:** Gestational diabetes occurred in a significant minority of Swampy Cree women and was associated with a number of adverse outcomes.

Gestational diabetes mellitus is defined as glucose intolerance first recognized during pregnancy. Although there has been considerable research on gestational diabetes in native populations, few investigators have examined Indian populations in Canada.[1]

In 1993 Livingston and colleagues[2] reported that 3.2% of Tohono O'odham Indian women in southern Arizona had pregnancies complicated by diabetes. A 4-year study of gestational diabetes in Zuni Indian women of western New Mexico showed that 14.5% of pregnancies (13.9% of pregnant women) manifested the disease.[3] In Canada, Harris and associates[4] reported on diabetes and gestational diabetes in pregnant

Ojibwa and Cree women in northwestern Ontario. They found the prevalence of gestational diabetes to be 8.4%.

Increased age,[5–8] obesity,[5–8] a family history,[7,8] low socioeconomic status[7] and hypertension in pregnancy[8] have been shown to be independent risk factors for gestational diabetes. Among the Ojibwa and Cree women in Ontario the development of gestational diabetes was associated with increased maternal age, multiparity, prepregnancy obesity, a family history of diabetes and a history of gestational diabetes in a previous pregnancy.[4]

Gestational diabetes has been associated with increased illness in the infant. Complications include a significantly higher incidence of macrosomatia (birth weight over 4000 g), hypoglycemia, hypocalcemia, hyperbilirubinemia, polycythemia and serious congenital abnormalities.[9–11]

We studied gestational diabetes in the Cree population of James Bay that are cared for at Weeneebayko Hospital in Moose Factory, Ont. Specifically, our objectives were to estimate the prevalence of gestational diabetes, to determine factors predictive of the occurrence of the disease, and to identify delivery and infant outcomes related to the disease.

## Methods

We studied Swampy Cree women who gave birth at Weeneebayko Hospital, Moose Factory, James Bay, Ont., between Jan. 1, 1987, and Dec. 31, 1995.

Weeneebayko Hospital provides care for the Swampy Cree who live in Moose Factory and in the communities along the western side of James Bay. The area has a population of about 9000, of which 95% are Swampy Cree. Obstetric care is provided by family physicians and a general surgeon, who provides cesarean section capability. About 120 to 160 women give birth in Moose Factory each year. Because emergency and elective cesarean section are available, patients are transferred only occasionally, generally for reasons of extreme fetal prematurity, in other situations in which the need for a neonatal intensive care unit is expected, or when the woman has a serious medical illness.

Only women with a band number and, therefore, officially recognized as having Native status were included in the study. This was the best means to ensure that only Cree women were included. Women who were transferred out of Moose Factory for delivery (a total of 30) were not included; none of the 30 had gestational diabetes.

The charts of all women who gave birth at Weeneebayko Hospital during the study period were identified. Using a standardized chart abstraction form, we collected data on the birth, including maternal characteristics and medical history, details of the labour and delivery, and details of the infant's condition and postpartum stay in hospital. Patients were excluded from the study if large amounts of data were missing from the chart.

A woman was determined to have gestational diabetes in 1 of 2 ways: an oral glucose tolerance test was done during pregnancy, and the result met the criteria for gestational diabetes outlined by the International Workshop-Conference on Gestational Diabetes;[12] or a fasting sugar or a 1-hour 50-g challenge test was done and resulted in a blood glucose value of 7.8 mmol/L or more, and it was evident from the chart that the physician considered the patient as having gestational diabetes.

Ethics approval was obtained from the Research Ethics Board of Queen's University, Kingston, Ont.

We used descriptive, univariate statistics, bivariate statistics ($\chi^2$ test and *t*-tests) and logistic regression analysis in evaluating the data. Because the frequency of gestational diabetes was relatively low in the population, odds ratios were interpreted as relative risks (RRs).

**Table 1: Factors related to the development of gestational diabetes mellitus in Swampy Cree women in Moose Factory, James Bay, Ont., 1987–1995**

| Characteristic | No. (and %) of pregnancies: With gestational diabetes *n = 110* | No. (and %) of pregnancies: Without gestational diabetes *n = 1188* | Unadjusted RR (and 95% CI) | Adjusted RR (and 95% CI) |
|---|---|---|---|---|
| Age, yr | | | | |
| < 20* | 12 (10.9) | 266 (22.4) | 1.0 | 1.0 |
| 20–34 | 88 (80.0) | 887 (74.7) | 2.2 (1.2–4.1) | 1.3 (0.6–2.6) |
| ≥ 35 | 10 (9.1) | 35 (2.9) | 6.3 (2.6–15.7) | 4.1 (1.5–11.7) |
| Primiparous | 19 (17.3) | 308 (25.9) | 0.6 (0.4–1.0) | 1.2 (0.7–2.3) |
| Past history of gestational diabetes | 28 (25.4) | 33 (2.8) | 12.0 (6.9–20.7) | 6.4 (3.5–11.7) |
| Past history of cholocystectomy | 11 (10.0) | 48 (4.0) | 2.6 (1.3–5.2) | 1.4 (0.6–3.0) |
| Diastolic blood pressure at first prenatal visit ≥ 80 mm Hg | 37 (33.6) | 174 (14.6) | 3.0 (1.9–4.5) | 1.7 (1.1–2.8) |
| Weight at first prenatal visit, kg | | *n = 1171* | | |
| ≤ 60* | 5 (4.5) | 221 (18.9) | 1.0 | 1.0 |
| 61–80 | 35 (31.8) | 615 (52.5) | 2.5 (1.0–6.3) | 1.8 (0.7–4.8) |
| > 80 | 70 (63.6) | 335 (28.6) | 9.2 (3.7–23.3) | 4.9 (1.8–12.9) |
| Past history of pregnancy-induced hypertension | 17 (15.4) | 53 (4.5) | 3.9 (2.2–7.0) | 1.4 (0.6–3.5) |
| Family history of diabetes | 79 (71.8) | 497 (41.8) | 3.4 (2.2–5.2) | 1.1 (0.5–2.4) |
| First-degree relative with diabetes | 68 (61.8) | 328 (27.6) | 4.3 (2.8–6.4) | 3.0 (1.4–6.1) |

Note: RR = relative risk, CI = confidence interval.
*Reference category.

## Results

A total of 1401 deliveries occurred at Weeneebayko Hospital during the study period, of which 1298 were included in the study. Gestational diabetes was diagnosed in 110 (8.5%) (95% confidence interval [CI] 6.9%–9.9%) of the 1298 pregnancies. Among the 110 pregnancies, gestational diabetes was considered to be present on the basis of an oral glucose tolerance test in 69 cases (63%) and of a 1-hour 50-g blood glucose test in 21 cases (19%). In the remaining 20 cases (18%) the woman had a fasting glucose level of 7.8 mmol/L or higher and was considered by her physician to have gestational diabetes.

Several factors were found to be associated with the development of gestational diabetes (Table 1). Women aged 35 years or more were 4 times more likely than those under 20 years to have the disease (95% CI 1.5–11.7). Women with a past history of gestational diabetes were 6 times more likely to have gestational diabetes than those without a past history (95% CI 3.5–11.7). Women with a diastolic blood pressure of 80 mm Hg or more at the first prenatal visit were nearly twice as likely to have gestational diabetes as women with a lower diastolic blood pressure (95% CI 1.1–2.8). Finally, women who weighed more than 80 kg at their first prenatal visit were 5 times more likely to have gestational diabetes than those who weighed 60 kg or less (95% CI 1.8–12.9).

Any family history of diabetes and a personal history of having undergone cholecystectomy appeared to be positively associated with gestational diabetes, but these associations were no longer statistically significant after adjustment for other determinants (Table 1). However, women who had a first-degree relative with diabetes were 3 times more likely to have gestational diabetes than women without this family history, even after adjustment for other determinants of gestational diabetes (95% CI 1.4–6.1).

**Table 2: Delivery outcomes in women with and without gestational diabetes**

| Outcome | No. (and %) of pregnancies: With gestational diabetes | Without gestational diabetes | RR (and 95% CI) |
|---|---|---|---|
| Cesarean section | 20 (18.2) | 149 (12.5) | 1.6 (0.9–2.6) |
| Episiotomy | 12 (10.9) | 160 (13.5) | 0.8 (0.4–1.5) |
| Perineal tear > 1° | 15 (13.6) | 235 (19.8) | 0.6 (0.4–1.1) |
| Assisted vaginal delivery (forceps or vacuum extraction) | 6 (5.4) | 24 (2.0) | 2.8 (1.1–7.0) |
| Shoulder dystocia | 6 (5.4) | 21 (1.8) | 3.2 (1.3–8.1) |
| Postpartum hemorrhage | 8 (7.3) | 91 (7.6) | 1.0 (0.5–2.0) |
| Retained placenta | 3 (2.7) | 29 (2.4) | 1.1 (0.3–3.7) |
| Meconium | 7 (6.4) | 50 (4.2) | 1.6 (0.7–3.5) |
| Nuchal cord | 8 (7.3) | 45 (3.8) | 2.0 (0.9–4.3) |
| Breech presentation | 2 (1.8) | 16 (1.3) | 1.4 (0.3–6.0) |

Only 2 delivery outcomes were significantly associated with gestational diabetes (Table 2). Shoulder dystocia was 3 times more likely to occur during delivery in women with gestational diabetes than in those without gestational diabetes (95% CI 1.3–8.1), and assisted vaginal delivery (forceps or vacuum extraction) was nearly 3 times more likely to be required in the former group (95% CI 1.1–7.0). Babies born to women with gestational diabetes were 2.4 times more likely than those born to women without the disease to weigh more than 4500 g at birth (95% CI 1.4–3.8) (Table 3). Controlling for birth weight attenuated the association between gestational diabetes and shoulder dystocia (RR 2.1, 95% CI 0.8-5.5, $p = 0.14$), which suggested that birth weight lies in the causal pathway between gestational diabetes and shoulder dystocia. Logistic regression analysis with assisted vaginal delivery as the dependent variable and gestational diabetes and birth weight as the independent variables showed that the need for assisted vaginal delivery was related to gestational diabetes (RR 2.7, 95% CI 1.1-6.9, $p = 0.03$) but not to birth weight (RR 1.1, 95% CI 0.6-2.1, $p = 0.72$).

There was no difference in the Apgar scores, the rate of congenital anomalies or the neonatal death rate between the 2 groups (Table 3). The congenital anomalies included all that were noted in the chart, including minor anomalies such as birthmarks and webbed toes. Compared with babies born to women without gestational diabetes, those born to women with gestational diabetes were 7 times more likely to have had hypoglycemia after birth (95% CI 3.7–14.4), 9 times more likely to have experienced hypocalcemia (95% CI 2.3–33.7) and 3 times more likely to have received phototherapy for jaundice (95% CI 1.4–6.1) (Table 3).

## Interpretation

Widely varying rates of gestational diabetes have been reported in the literature, from 2.4% among Bedouin women in Israel[1] to 15.3% among Zuni Indians in western New Mexico.[7] Most reports put the rate of gestational diabetes in the range of 4% to 8%. The rate of 8.5% that we

**Table 3: Infant outcomes in the 2 groups**

| Outcome | No. (and %) of pregnancies: With gestational diabetes | Without gestational diabetes | RR (and 95% CI) |
|---|---|---|---|
| Infant weight > 4500 g | 24 (21.8) | 126 (10.6) | 2.4 (1.4–3.8) |
| Apgar score < 7 at 1 min | 17 (15.4) | 204 (17.2) | 0.9 (0.5–1.5) |
| Apgar score < 7 at 5 min | 4 (3.6) | 30 (2.5) | 1.5 (0.5–4.2) |
| Hypoglycemia | 15 (13.6) | 25 (2.1) | 7.3 (3.7–14.4) |
| Hypocalcemia | 4 (3.6) | 5 (0.4) | 8.9 (2.3–33.7) |
| Jaundice requiring phototherapy | 10 (9.1) | 39 (3.3) | 2.9 (1.4–6.1) |
| Any congenital anomaly | 14 (12.7) | 111 (9.3) | 1.4 (0.8–2.6) |
| Neonatal death | 1 (0.9) | 8 (0.7) | 1.4 (0.1–10.9) |

observed among Swampy Cree women is similar to that reported by Harris and associates[4] among Ojibwa and Cree women in northwestern Ontario but is not as high as that documented among native people in other parts of North America.[3]

Independent risk factors for gestational diabetes in Swampy Cree women included age over 34 years, a past history of gestational diabetes and presence of first-degree relative with diabetes. These findings are consistent with other reports in the literature, including that by Harris and associates.[4] The woman's diastolic blood pressure and weight at the first prenatal visit also seemed to be predictive of gestational diabetes, but the relation was less strong.

Although significantly more babies of women with gestational diabetes than of women without gestational diabetes weighed more than 4500 g at birth, there was no significant difference in the rates of cesarean section, episiotomy or perineal tears between the 2 groups. The overall cesarean section rate among Canadian women in 1993 was 18%,[13] whereas the rate among Swampy Cree women without gestational diabetes was 12.5%. However, 30 of the higher risk pregnancies had been referred out to secondary or tertiary care centres.

In our study, the rate of assisted vaginal delivery (forceps or vacuum extraction) was higher among women with gestational diabetes than among those without the disease. This finding is of importance to family physicians practising in rural areas with large native populations, who should be skilled in the use of these devices. This has implications for family medicine residency programs that train and encourage physicians to practise in rural areas. Of interest, the overall rate of assisted vaginal delivery in our study, 2.5%, is much lower than that reported in obstetric training programs in North America,[14] where the rates may be as high as 10%.

Although gestational diabetes seems to have little effect on the course of labour, the infants tend to be sicker. Their immediate health appears normal, as indicated by Apgar scores, but they are more likely to have hyperbilirubinemia, hypoglycemia and hypocalcemia. This is of particular importance in the context of early discharge of women and infants after delivery. Infants of women with gestational diabetes should probably be watched in hospital for 48 hours and should not be discharged within the first 24 hours.

It was not possible with chart abstraction of data to get a good sense of how well the glucose levels were controlled or how well dietary recommendations were followed. It is possible that the ill effects seen in the infants could have been prevented by better control of blood glucose levels.

Our study suffers from the weakness inherent in any study that depends on retrospective abstraction of data from medical records: missing and illegible information, and difficulty with interpreting the meaning of notes and comments. However, because of the method of filing used, we are certain we had access to the charts of nearly all pregnant women who gave birth at the hospital. The results are probably generalizable to other rural hospitals caring for a primarily native population. However, similar studies of obstetric care in native populations in Canada should be done to provide a more complete picture of the situation and to identify gaps or deficiencies that may need to be addressed.

Competing interests: None declared.

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